ON THE

RELATION OF THERAPEUTICS

TO

MODERN PHYSIOLOGY.

BY

HENRY R. MADDEN, M.D. Edin.

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The vital importance of correctly appreciating the relation subsisting between the science of therapeutics and that of physiology, is such as to demand for the study of this relationship the earnest attention of all physicians. To do justice to its investigation within the limits of a single essay is well nigh impossible. I must therefore crave the indulgence of my readers if, in the endeavour to be concise, I should appear in any degree to have sacrificed clearness of expression to condensation of statement, or should any of the facts referred to be unaccompanied by those proofs of their accuracy which might readily be adduced.

As my subject deals with the fundamentals of a scientific therapeia, I have to treat first of the fundamental laws of physiology ere I can relate the one to the other.

The visible universe may be said to consist of *matter* and *motion*, both equally indestructible and incapable of production. The absolute amount of both is ever the same, and all the variety which we

see around us is the result of modifications of the one or of the other.

Physical science has taught us that all the forces in nature are modes of motion, and has more than hinted that all the forms of matter may be equally dependent upon the same great agent, while life is so distinctly a *mode of motion*, that on an examination of its laws rests the very foundation of physiology.

In studying motion, it is first of all necessary to distinguish between the visible movement of masses and the invisible motions of molecules. Upon the former, however, I shall not at present enlarge.

Molecular movements are of two classes, viz. movements among themselves, and movements within themselves.

With *atoms* we can have no practical acquaintance, the smallest mass detectible by the highest microscopic power is still a molecule, or more probably a considerable group of molecules.

Chemistry teaches us that even the so-called elements exist in molecular groups of atoms, and act only when thus associated—nay, there are not wanting those who believe with the late Dr. Samuel Brown, that all the difference between one element and another consists in different groupings of the ultimate particles, so that atoms themselves are groups, and we know absolutely nothing of the one indestructible substance which underlies all phenomena, our utmost knowledge extending only to the products of its groupings.

According to this view, the atomic weight of an element expresses either the relative complexity of its molecule, or the velocity of the revolution of its constituent particles.

Apart from this, however, which is not as yet the accepted theory, although much may be said in its favour, the well-studied subjects of electricity, galvanism, and magnetism, lead almost inevitably to the conclusion that motion exists in all molecules at all times, and that to its modifications are to be traced all the various phenomena to which these sciences relate.

Heat is another mode of motion, and the perceptible temperature of any body is the measure of the rate at which its molecules are vibrating at the time; while radiant heat consists of the same vibrations transferred to the subtle ether that fills all space and envelopes the molecules of the densest materials.

Radiant heat and light are products of the same waves of ether, and differ only in size and velocity; the larger and more slowly moving waves causing the phenomena of heat, while the smaller and more rapid vibrations manifest their presence as light.

It will thus be perceived that the whole field of physics is occupied with investigations relating to modes of motion. It, however, limits itself to such motions as occur in masses and among molecules, and leaves to other sciences the examination of those movements that are more deeply seated.

At this point chemistry takes the initiative, and

explains to us that various molecules have the power of uniting together, and forming compounds possessing properties totally distinct from those of either of its constituents. In other words, certain molecules on coming together break up their internal arrangement, and combine to form an entirely new arrangement having a new motion, and hence manifesting new properties. Whence it follows that in all chemical compounds the complexity of the internal arrangement of each molecule, and as a consequence its mode of motion will bear a direct relation to the number of atoms of which it consists —ternary compounds being more complex than binary, and so on. This increasing complexity, however, depends on the number of atoms quite as much as on the number of elements existing in a compound, and hence it is that two elements uniting in the proportion of four atoms with five will produce a much more complex arrangement than if they united as one to one or one to two, or even as one to four.

I have observed that elements are only known in the form of molecules, and that even in this uncombined state the grouping of the ultimate atoms may differ is evidenced by the phenomena of *allotropism.*

We know that the properties of a body are dependent upon the arrangement and mode of motion of its constituent particles, and hence it follows that the atoms of such substances as oxygen, phosphorus, sulphur, carbon, &c., must be capable of assuming and retaining very different arrangements ere they

could manifest the very divergent properties characteristic of their allotropic states. While, on the other hand, the facts of *Isomerism* clearly demonstrate the same capability to exist in compounds. The almost innumerable and utterly diverse forms in which carbon and hydrogen, when united in the proportion of ten to sixteen, can appear, is shown by the fact that no less than twenty-three volatile oils, including such very different substances as *turpentine*, *chamomile*, *clove*, *juniper*, and *valerian*, possess the same proportion of these two elements.

Another great advance in complexity of arrangement is found in what Graham has named the *colloid* condition. The late Dr. Miller writes: "The chemistry of a body in the colloid condition is very different from that of the same body in its crystallised form." And again, "The combining proportion of colloid is generally high, although the ratio between the elements of the substance may be simple, and it seems not to be improbable that the grouping together of a number of crystalloid molecules may be one of the essential requisites for the development of the colloid condition."*

If then such a compound as C_{10}, H_{16}, is capable of so many modifications, what might we not expect from a colloid-like albumen, whose formula, according to Dr. Miller, is C_{72}, H_{110}, N_{18}, SO_{22}, H_2 O, or in other words 226 atoms of five elements at least, two of which have already been shown to be remarkable for their allotropic modifications?

* Miller's 'Chemistry, 3rd edit., vol. iii, p. 88.

Most colloid substances belong to the organic kingdom, and it is well known that no crystalloid can become part of a living organism until it has been brought into the more complex colloid state.

During life, however, the constitution of the molecule is still more complicated than in the colloid condition, and the act of death evidently consists in the breaking up of this most complex of all molecular arrangements into the less complex colloid, and the more simple crystalloid forms of matter. This condition has been termed by Dr. Drysdale *the metabolic state*, and is especially characterised by the following peculiarity, viz. that all ordinary chemical affinities are suspended. This is supposed to be occasioned by the circumstance that its constitution is perpetually changing, so that ordinary chemical compounds cannot be formed. Most chemical combinations require time, and the rate at which the constituents are brought together and the duration of their contact will materially influence the result; so much so indeed that advantage is taken of this fact in the arts to accomplish purposes which would be otherwise unattainable. For example, before calico can be printed every loose particle of cotton must be removed from the surface, in order that the coloured inks may not run and damage the clear outline of the pattern. This removal is effected by passing the calico over and in contact with a red hot iron cylinder, and by regulating the rapidity with which the cylinder revolves and the calico passes over it, the intense heat burns off the loose fibres,

and yet does no injury to the woven cloth. In other words the changes in the relation of the high temperature and the cotton are too rapid to admit of the fibre combining with the oxygen. Let the rate of revolution be reduced but a very little, and the calico would burst into flames. Again, it has been found that certain fulminates can be detonated in contact with gun-cotton without causing the latter to explode; and experts account for this on the ground of the extreme rapidity with which these fulminates expand, too rapid indeed to enable the *pyroxyline* to initiate its new mode of motion, and hence it remains unchanged. Precisely the same kind of thing occurs in the metabolic state of matter. It can only last so long as rapid and incessant changes are going on, for which purpose it must always be in contact with living matter; and if the rate of these changes is reduced beyond a certain point, the chemical affinities of the materials will at once assert themselves, and the whole will break down into more or less stable chemical combinations.

This subject is far too vast to admit of my bringing forward proofs of all these assertions, but they will readily be found by all who are conversant with recent writings bearing on these questions.

I have now, therefore, reached the confines of physiology, and have pointed out four classes of complexity, each of which contains many degrees, viz.:

1st. *Atomic complexity*, varying in accordance with the atomic weight of the element.

2nd. *Chemical complexity*, varying according to the number of elements and the number of atoms of each which go to form each chemical combination.

3rd. *Colloid complexity.*

4th. *Metabolic complexity.* It has likewise been shown that this last and most complex molecular arrangement of all must be reached ere the phenomena of life can be manifested.

Approaching the subject from a different side it may be stated that the simpler the molecular arrangement, the more stable is the mass, and the fewer are its properties ; while conversely, the more complicated the molecular arrangement, the more readily can it be interfered with, and the more numerous and diverse its properties.

The simplest living organism is, therefore, possessed of many and various properties, and is capable of being readily altered by a variety of causes.

The invaluable researches of Dr. Lionel Beale have proved that the only *truly living* matter is a "pulpy, translucent, homogeneous matter, yielding, after death, fibrin." This is the *germinal matter* of Beale, the *protoplasm* of many recent writers. All visible structure comes from this, but according to Beale, *all formed matter is dead;* an assertion which in the highest sense is perfectly true.

In our physiological researches, therefore, we have here a fresh starting point. This structureless pulp, this *germinal matter*, is, as has been shown, the maker of all structures.

Every living cell, whether animal or vegetable, consists of one or more masses of germinal matter enclosed in the cell-wall. This cell-wall is just as much produced by the germinal matter as the cocoon is produced by the silk-worm. As the larva consumes food (pabulum) and converts it into its own substance, and from thence produces the silk and spins the cocoon, so germinal matter receives pabulum, converts it into its own substance, and from thence produces the albumen, or fibrin, or whatever else constitutes the material of the cell-wall; and therewith builds the wall around itself. Unless therefore it would be proper to call silk living so long as the enclosed larva is alive, it cannot be correct to call the cell-wall living simply because it contains live germinal matter.

From the simple cell constituting a *monad*, to the most intricate structure constituting the cerebral hemisphere in man, precisely the same series of phenomena obtains: everywhere there is germinal matter, and everywhere there is formed material. Among much that is deeply interesting in this field of research, the one essential thing to be noticed is, that as we ascend the scale we find greater and greater complication of arrangement, and hence an ever-increasing capability of becoming deranged.

The extremely complex molecular constitution of germinal matter, or in other words, of molecules in the metabolic state, is essential to its possessing that peculiar property to which Fletcher gave the name of "*irritability*," or the power to respond to

stimuli; or, to express it in other words, the property of changing its condition in response to impressions. That a molecular arrangement far more simple than that of germinal matter is sufficient to render it responsive to certain impressions is well known. For example, *biniodide of mercury* can be obtained in large lemon-yellow crystals, which retain their colour if perfectly undisturbed; a very slight shock, however—for example, a mere scratch with a needle—will produce a vermilion colour at the point of contact, which will rapidly spread all over the crystal, however large its size, and indeed very frequently over the entire mass of crystals lying in contact with each other. Now the laws of optics teach us that the physical cause of colour lies in the molecular arrangement of the coloured mass; and hence in this case a change of molecular arrangement must have been set going by the very small mechanical disturbance of one point of the surface of our crystal of *biniodide of mercury*. The firing of a charge from a needle-gun is another well-known instance of the stimulus of pressure on one minute spot, originating a sudden and entirely new molecular arrangement of the whole mass.

Fletcher long ago pointed out, and Drysdale has recently reminded us, that three things are essential to the existence of life, viz.:

Irritable matter to act.

Pabulum, to be acted on.

Stimulus, to cause action.

In all animals and vegetables, from the highest to

the lowest, these constitute all that is essential to life; and the *changes, which irritable or germinal matter undergoes, constitute the whole of the phenomena of life.*

The incalculable variety of structure and action manifested by living beings is but the record of the variety of properties which characterise "pulpy, translucent, homogeneous matter, yielding after death, fibrin."

Dr. Beale says that germinal matter is always the same, no matter from what source it is obtained; but Dr. Drysdale well remarks that this applies only to its microscopical and chemical character, and not to its most important and characteristic property, viz. the way in which it responds to stimuli; in this respect there are as many species of germinal matter as there are diversities of structure and function throughout the organic world.

I must now return for a while to consider the various modes of motion.

The doctrine of the correlation of forces has shown the indestructibility of motion, and in consequence its ceaselessness. Whenever motion seems to disappear, it is owing to its having been transferred from masses to molecules. When motion becomes heat, as in the boring of a cannon, the locomotion of the mass has been shivered into the thermal vibrations of the molecules. When light is absorbed the rapid waves of the ether have been massed into the slower swing of the molecules of the absorbing bodies, and so on through all

changes; what seems to be *coming to rest* is simply a change of the mode of motion, and what is termed the *storing up of force*, is in like manner the accumulation of molecular motion within the receptive mass.

A very simple and instructive example of the storing up of force is seen in the American machine termed "*The Accumulator*," by means of which the lonely bushman can at any time obtain the power of ten or twelve men. It consists of a series of india-rubber cords, each furnished with a hook at one end and a ring at the other, and when the person wishes to move a weight far heavier than his strength can accomplish, he fastens a strong rope round the object to be moved, and drives a stake firmly into the ground at such a distance from it that the india-rubber cords must be fully stretched before they can reach from the one to the other. He then takes one cord of the caoutchouc, hooks it into the rope which surrounds the mass to be moved, and then stretches it until he can pass the ring over the stake. To do this he must exert his full strength, and as the caoutchouc remains stretched a traction-power equivalent to his full strength continues to drag on the mass. Proceeding in like manner to apply cord after cord, he obtains a traction equal to as many men as he has stretched cords; and at last, on stretching another cord, the mass is moved. Here we have manifest storing up of force in the stretched cords; and yet there is no apparent motion, all visible motion has ceased and been

replaced by what is usually termed "tension" or "potential energy." I have purposely, however, avoided this word in order to show that what is called tension is also a mode of motion.

Let me now examine the condition of the caoutchouc before and after it was stretched. In its passive condition the molecules of caoutchouc are evidently swinging freely through a comparatively large space, so large as to admit of their readily moving upon each other in all directions; and it is this condition that renders the substance capable of being stretched at all. At the same time the attraction between its particles is very strong; this attraction being also a mode of motion, as indeed are all the manifested properties of matter. When, however, it is fully stretched, the force exerted in stretching it has altered the arrangement of its molecules so materially that it is now hard and brittle, instead of being soft and elastic, so brittle indeed that any extra force would break it; hence the wide swing of the soft elastic mass has been broken up into the short rapid molecular movements of a hard, brittle substance, and this change represents an increase of molecular motion exactly equal to that expended by the man in stretching the cord. Thus it will be perceived that "tension" or the "storing up of force" really means the transfer of motion from masses to molecules. Why caoutchouc has the power to resume its original mode of molecular motion as soon as it ceases to be retained in its stretched condition, while an equally extensible mass

of glue would remain permanently in the stretched condition, is for the present inexplicable. It constitutes a *property* of the caoutchouc, and in this manner serves to differentiate it from substances which are ductile and plastic, but inelastic.

There can be little doubt that variation in molecular arrangement lies at the root of all the properties of all differing substances, but it is essential to remember that *motion imparted to a substance and not passed on or changed into some other visible form of motion, is equalised by some new form of molecular motion in the substance thus retaining it.* Those who wish to enter more fully into this question should study carefully Dr. Drysdale's second chapter on the *Nature and Definition of Force*, in the twenty-eighth volume of *The British Journal of Homœopathy*.

The next point to be borne in mind as necessary to a correct knowledge of this subject, is the essential distinctions between *properties* and *force*. I will therefore endeavour to formulate these before proceeding farther.

Force is distinct from, though only conceivable as acting upon, matter.

Properties are attributes of matter.

It is quite possible to conceive of matter void of force, but it cannot be conceived as void of properties.

Force is—and must be always—in exercise.

Properties may be in exercise or not.

Force is *motion*, one and indestructible; it may vary in mode of manifestation, but cannot vary in amount.

Properties are infinitely various, may be destroyed and reproduced; are absolutely dependent on circumstances, changing or unchanging as the circumstances vary on which they depend.

Throughout the universe matter does not exist without force. All the forms of motion, all the force in this world is derived from the sun; and a fresh supply is constantly required to compensate for the loss which this world sustains in the form of radiant heat and light incessantly passing out beyond the limits of our atmosphere.

I may sum up this part then with the assertion, that *force, acting upon matter, calls its properties into exercise, and the result is, in every instance, regulated by the nature of these properties.*

One body may act upon another in two very different ways.

1. It may simply transmit its own motion, as when one ball is pushed against another, and passes on to it a portion of the force with which it was impelled towards it.

2. It may set free an amount of motion far greater than that it transmitted; in consequence of the matter acted upon having already a store of force ready to be called into activity, as when a cap with a hammer explodes a mass of *dynamite*, or any other detonating mixture. Now this latter mode of action is termed *stimulation*, and the acting body is termed a *stimulus;* and we must never forget that a mechanical agent produces an effect which is the exact equivalent of the force it transmits, while a *stimulus* produces an effect greater than the amount of force

it transmits—the increase being always set free from a store previously existing in the matter acted on. There is thus an apparent, but no real production of force. The excess is extricated, set free, not produced; and the substance acted upon invariably suffers loss. It loses more or less of some property which it possessed in virtue of the store of force laid up in it. For instance in the example quoted, *dynamite* possessed the property of sudden and enormous expansion; but as soon as its store of force was liberated this property was lost; and seeing that this very property was an essential characteristic of the *dynamite*, this latter at the same moment ceased to exist, and its elements arranged themselves in entirely new forms.

These three things must therefore be remembered, that:—1. *The effect of a stimulus is greater than its mechanical power.* 2. *Matter which is capable of responding to a stimulus must possess a store of force.* 3. *When any matter responds to a stimulus it invariably suffers loss.*

It need scarcely be remarked that that which Dr. Fletcher calls *irritable matter*, and which Dr. Lionel Beale calls *germinal matter*, is capable of responding in a striking degree to numerous stimuli; and it has been shown that this is owing to the extremely complex character of its molecular structure: for, be it remembered, every complication of molecular structure involves an increased amount of molecular motion, and hence each step in the complexity implies a storing up of force.

The confines of physiology have thus again been reached from the side of force, as they had previously been from the side of matter; and we are now prepared to pass rapidly *in medias res.*

The ascent from the monad to man is a constant series of complications or unfoldings, by which force is stored and properties are multiplied. The complications, however, are of two kinds, viz. complications of structure and complications of molecular arrangement. The mass becomes more and more differential, and the molecules composing it more and more complex in their properties.

Every organ of the body consists essentially of cells containing germinal matter; and every difference of function depends upon the equivalent differences in the properties of this "homogeneous translucent mass," these again are the evidence of a different molecular constitution.

Every cell, therefore, possesses an independence traceable to its peculiar constitution; and every cell acts according to this peculiarity, and cannot act in any other way until its molecular arrangement is changed.

Germinal matter—being irritable—responds to stimuli, and in so doing suffers loss; hence, while it it lives (and it only retains its peculiar constitution during life), it must receive a constant renewal from without, and this renewal must, in its turn, possess a store of force. There must, therefore, be *pabulum*, and then we have our three prime requisites of life viz. *germinal matter*, *stimulus*, and *pabulum.*

Each mass of germinal matter increases by the absorption of pabulum, and coincidentally produces some formed matter, either a structure or a formed secretion.

All *formed material*, whether structural or amorphous, is no longer in the metabolic state, it is reduced to the lower grades of colloidal and chemical complexity; and hence force is set free, and either passes on as one of the known physical forces, or is employed in raising the absorbed pabulum to a higher degree of metabolic complexity.

The time during which an individual molecule retains its identical metabolic state is probably very short indeed; there is an incessant passing upwards and downwards of molecules from one degree of complexity to another, so that the condition is essentially one of change so long as life continues; and the essential point for us to remember is, that every step of the upward progress increases the amount of stored-up force (molecular motion—tension), while every descending step sets force free.

Individual masses of germinal matter are possessed of three most important properties, viz.:—

1. The power to undergo molecular changes on the application of a stimulus.

2. The power to *reproduce its like*, or, translating this into a mode of motion, the power to impart its own molecular motion to molecules of an analogous kind, thus prolonging changes of motion.

3. The power of returning after a time to its

original mode of motion, and thus terminating changes of motion.

This is claiming for the individual molecules what Darwin has so abundantly proved as regards the entire living creature, viz. the power to perpetuate a change, and the tendency to revert to original forms.

Practically one cannot exaggerate the importance of these facts, because if the molecule had not the power to perpetuate change, no disease could have any duration—the molecule must either retain its health or die. If again the tendency to revert was lost, no disease could be cured—a change once produced would be perpetuated.

With these facts before us respecting the constitution and manner of life of each separate mass of molecular matter, I proceed to the examination of the entire animal.

The body, occupying a large space, consisting of nearly twenty-three millions of cells, and performing all its complex functions, is an undivided whole—an *individualism*. The independent cell-life must, in some manner, be associated together; and this is effected in the most perfect way by a two-fold circulation, which continues unceasingly throughout the entire mass, viz. the circulation of pabulum (the blood), and the circulation of nervous influence. The first associating all the cells together as a matter of life and death, being all dependent on one commissariat. The second associating them for unity of action, being all under one government.

I shall now very briefly consider these two circulations upon which the unity and integrity of the body absolutely depend.

1. *The circulation of the blood.* Recent observation has added largely to our knowledge of blood-making. The most important point of which, for our present purpose, is that every particle of food must have again and again become part of living and growing tissue ere it enters the blood-stream. Just as no animal can live directly on inorganic matter, but must receive its elements from the vegetable kingdom, so in the higher animals all food must have become the germinal matter of intestinal cells, of colourless and other corpuscles, and of various lacteal or lymphatic glands, ere it is fit to be mingled with the blood. And again after entering the circulation, the same ascending series of changes takes place; in fact there is the highest probability that in every change of germinal matter, except that which occurs in the ideational centres, three things occur; a certain number of molecules, pre-existing in the pabulum, are raised to the level of the germinal mass that has absorbed them, a small number of those pre-existing in the germinal matter attain a higher degree of complexity of arrangement, and pass on to be the food of higher tissues, and a larger number, probably derived partly from germinal matter, and partly from pabulum, descend to the level of formed material. The change consists entirely of a re-distribution of molecular motion; there is no additional force generated, but what is

set free by the degradation of some molecules is employed for the elevation of others.

Blood must not be viewed as a chemical mixture, for such it does not become until death. In the living body it consists of water containing matter in the crystalloid, colloid, or metabolic state, the last of these being capable of yielding molecules of vastly different degrees of complexity of motion; and just as the sun sends forth heterogeneous rays which can be separated into different parts by sorting together the waves of equal length; and just as different natural substances have the power of absorbing certain of these, and letting the others pass by, so the blood contains molecules of matter in the metabolic state; and each part of the body has the power of differentiating from it portions capable of assuming a mode of motion similar to that pursued by its own molecules.

That this apparent power of selection is a purely physical act is rendered highly probable from analogous changes which are perpetually occurring around us. These have been beautifully illustrated by Tyndall in his *Lectures on Sound*, where, speaking of sensitive or singing flames, he points out that each flame has its own particular note to which it responds; and that, although its sensitiveness to that particular note may be extreme, any number of other notes may be sounded loudly and continuously without producing the slightest influence upon it. This certainly looks quite as much like selection as anything which occurs in the living

body, yet it is well known to be a purely physical effect.

When the *liquor sanguinis*, containing the pabulum of all the tissues, passes by any cell, a portion enters by endosmosis, and comes in contact with the living germinal matter therein contained; being sensitive to all kinds of molecular movements, it responds to that of the germinal matter, and at once splits up into different rates of motion, part assuming the same mode of motion as the germinal matter itself, and thus attaining similar properties and becoming identified with it, while the remainder falls down to a lower rate of motion, and, with the other fluid contents, passes out of the cell by the exosmotic force which impels it forward.

While the constitution of the blood is thus for ever changing, its general composition remains unaltered so long as health continues; a marvellous result arrived at by the inter-dependence of all the various tissues on each other; and by the varying rates of nutrition of different parts of the body; a result, however, necessitating so nice a balance that it is easily disturbed, and thus constitutes a most fertile source of disease.

The pabulum being conveyed to all parts by the blood, the amount supplied is, of course, regulated and controlled by the circulation; and this again depends on the calibre of the arteries. Here, therefore, we touch the second circulation, viz. the nervous, for on it depends the contraction and relaxation of the blood-vessels. Without entering fully

into the physiology of the the nervous system, it is essential that I should here specially direct attention to a few points respecting it.

The nervous system, as at present known, is one of the most perfect systems of representative government that can be conceived.

The distal terminations of afferent nerves are the first recipients of impressions; the nerves are conductors; and there are four sets of nervous centres to which the impressions are conveyed.

Beginning at the lowest, Dr. Maudsley, from whose admirable work on *The Physiology and Pathology of Mind*, I have gathered much of my knowledge on this subject, remarks: "The ganglionic cell of the sympathetic co-ordinates the energy of the separate elements of the tissue in which it is placed, and thus represents the simplest form of the principle of individuation." In other words the separate cells of each tissue are linked together by the minute ganglia of the sympathetic, and are thus enabled to work together. These united cells next communicate with the ganglionic matter of the spinal cord; and if the message sent relates to a matter of which the cord has full cognizance and control, the answer is sent back direct, and the higher centres are not troubled with it,—this constitutes *reflex action*. If however, the cord is disturbed by the message, it passes it up to the *sensory ganglia* at the base of the brain, and from thence receives a message how to act,—here we have *sensation*. It often happens, however, that these centres are also sufficiently

disturbed to be induced to send the message still higher, and then it reaches the Throne itself, the *ideational ganglia* of the cerebral hemispheres,—and then we have *consciousness*. Dr. Maudsley well remarks that "each centre is *subordinated* to the centre immediately above; but is capable of determining and maintaining certain movements of its own without the intervention of its supreme centre." The strictest regularity exists in all these actions—each centre does its own work, when it has once learned it, thoroughly; but always refers to the higher centre in cases of doubt. Again, each higher centre in conducting its operations, makes use of the centres below as the proper and accredited channels of communication.

One of the most valuable subjects which Dr. Maudsley insists upon, and has developed so admirably and convincingly, is the "education of nervous centres," which is constantly going on during healthy life. According to this view, every display of energy leaves its mark behind it, which, becoming stronger and more distinct by every repetition, becomes at length the settled habit of the part. Dr. Maudsley expresses it as follows: "With the display of energy there is the coincident change or waste of nerve-element; and although a subsequent regeneration or restoration of static equilibrium takes place by the quiet process of nutrition, yet the nutritive repair, filling up the loss which has been made, must plainly take the form made by the energy and coincident material change. Thereby the

definite activity is to some extent realised and embodied in the structure of the spinal cord, existing there for the future as a motor residuum, a *potential* or *abstract* movement: accordingly there is thenceforth a tendency to the recurrence of the particular activity, a tendency which becomes stronger with every repetition of it . . . . . the faculties of the spinal cord are thus gradually formed and matured."* The formation of these organized residua, or rather organized groupings of cells, explains a vast number of phenomena both of health and disease. It explains all habits of the body and mind. It accounts for the difficulty experienced in performing novel complex motions compared with the automatic ease, amounting even to unconsciousness, with which the same are effected after long practice. It throws light on the tendency to recurrence of the series of morbid phenomena in many chronic diseases; and it explains the strange associations between apparently unconnected organs in many nervous patients.

According to Dr. Maudsley, "a spinal cord without memory," (*i.e.*, without organized residua), "would be simply an idiotic cord, incapable of culture." The same authority tells us that the groupings of cells, which exist at birth, consist of those associated with instinctive actions, hence these do not require to be learned. All other groups are organized by culture, and continue to be formed so long as the living being learns anything new.

* 2nd edit., p. 76.

As by far the greater part of the work done by the body is done by muscular fibre, it will be well to examine a little into the manner in which this is accomplished. Among the more recent explanations of the mechanism of muscular contraction, I am most inclined to agree with that advanced by Dr. Lionel Beale. He assures us that he has seen the ultimate nerve fibrils forming loops round the muscular fibrilla; and he views muscular contraction as analogous to the magnetizing of soft iron by a current of galvanism passing through a coil surrounding it. Physical science teaches us that such magnetization depends on an alteration of molecular arrangement occurring in the iron so long as the galvanic current flows through the surrounding coil. The microscope also teaches us that the rods (disdiaclasts) which exist in the cells of muscular fibre assume a different relative position during contraction, and thus cause the shortening of which this contraction consists; and, according to Dr. Beale, this change of position occurs whenever a nervous current is passing: so that muscular contraction represents a passing nerve current, while relaxation represents nervous repose. This is of importance, because it harmonises with facts of recent observations, such as the non-oxydation of muscle during action; and the nervous exhaustion consequent upon violent muscular efforts. If muscular contraction were indissolubly connected with muscular waste, many phenomena of daily occurrence would be inexplicable, more especially the fact established

by Dr. Parkes and others, respecting the elimination of nitrogen; as also the well-known fact that involuntary muscles never tire, at least in a state of health.

Sir James Paget has suggested a most ingenious explanation of this absence of fatigue of organic rhythmical movements such as those of the heart, of respiration, of cilia, &c., viz. that they are dependent on "rhythmical nutrition," *i.e.*, "a method of nutrition in which the acting parts are at certain periods raised, with time-regulated progress, to a state of instability of composition, from which they then decline, and in their decline discharge nerve-force."* In other words, the ganglionic cells, forming the central termination of the nerves supplying such muscles, grow and die, setting free their stores of force with a rapidity commensurate with the rate at which the muscles contract, a rate of growth by no means inconceivable, since it is equalled, if not surpassed, by the rate of development and rupture continually going on in the epithelium of secreting surfaces. Add to this regulated rapidity of growth the fact that the entire process is without consciousness, and, hence, makes no demands on the higher nervous centres, and we at once see that, so long as the organism works healthily, fatigue of such parts is impossible. The process goes on with all the steadiness of a water-wheel supplied by an uninterrupted stream, the force required for the work is always ready, each

* Maudsley, op. cit., p. 81.

minute's supply being yielded by the nervous system with as much regularity as the running stream sends down its wonted number of gallons of falling water.

To sum up what has been so rapidly sketched concerning the nervous system: We find that the linking together of the body into one is effected by the nervous system in such manner, that what would otherwise be desultory and chaötic assumes regularity and design. We find a series of centres placed one above the other, each having higher and more important duties to perform than the one before; and each consisting of molecules of a higher order of metabolic complexity, and, hence, possessing a larger amount of stored up force. We find each centre doing all the work it has learnt to do without referring to the higher powers; but ever seeking help when in difficulty; and, as a consequence, we find that fatigue is only felt when something new or unaccustomed has to be effected, or when, from disease, the balance between demand and supply has been lost.

While, however, the actions of all the various organs of the body are directed by the nervous system, and their nutrition regulated by the amount of pabulum which they receive; still the action performed in each case is absolutely dependent upon the properties of the cells constituting the organs themselves. Let these properties be altered in any way, and the action will differ, though the nervous stimulus remains the same. It is requisite, there-

fore, to enquire a little into the nature of stimulus; and, as this is by far the most important point of all in relation to therapeutics, I must be excused for entering into it somewhat minutely.

Recalling what has been already said with regard to germinal matter in the metabolic or living state, we must realise to ourselves molecules having a highly complex internal arrangement; and, as a consequence, capable of undergoing an almost infinite number of modifications. Such a molecule left to itself would be incapable of remaining unchanged. The various and antagonising movements going on among its elementary atoms would inevitably shake it to pieces; and out of the ruin would be produced numerous frail arrangements of a simpler order. In other words it would pass downwards through the colloid and chemical gradations until it rested in the more stable forms of simple, inorganic, chemical compounds. The only possible way in which the metabolic state can continue to exist is by the perpetual addition of fresh matter so constituted as to be capable of taking part in the intricate movements going on; and which are unceasing so long as life continues. In one sense, therefore, this pabulum may be called a stimulus in so far that it renders active the property, possessed by all the germinal matter, of reproducing itself.

Under ordinary circumstances, as long as germinal matter receives a supply of suitable pabulum, the presence of the latter determines a definite activity

in the former; and a uniform series of changes goes on, consisting, as has been already seen, of the increase of the germinal matter, and the production of formed material. Experience, however, teaches us that any change in the circumstances in which the germinal matter is placed, as also the presence of any unusual matter, may greatly modify or entirely change the character of the result; a change which usually shows itself in the character of the formed material. For example, under conditions of health the germinal matter of the epithelial layer of the mucous membrane produces only epithelial cells; and the surface of the membrane exhales water in sufficient quantity to be always moist; a very slight change, however, in its circumstances will cause this germinal matter to appropriate pabulum too rapidly, to form the cell-walls hastily; and, as a consequence, a number of unmoulded cells are set free and floated off in the water with which they are surrounded, thus constituting a mucous flux. Let the change of circumstances be somewhat greater, and the rapidly formed cells will manifest a new property, viz. that of forming oil globules as well as cell-walls; and then we have pus in place of mucus. As a consequence of still further changes, the pus formed may be no longer the bland, creamy matter which covers a healthy sore, but a thin, acrid ichor which modifies the life of every portion of germinal matter with which it comes in contact. A still further change may render the germinal matter incapable of forming solid cell-walls; and, as a

consequence, the mucous membrane becomes denuded of its proper covering, mass after mass of germinal matter is washed away; and we have an ulcerated surface. Now in all these instances the germinal matter has been stimulated in some unwonted manner, and has responded to the stimulus by doing unwonted work. It follows, therefore, that everything which can change the actions of germinal matter or pabulum, is a stimulus; and seeing that in all the above instances the germinal matter and pabulum did all the work, no new matter having been added, the stimulus must have acted by changing the inter-molecular motion of the mass, or, in other words, it set the change going, but took no further part in the result produced. All this accords with what we have here already seen concerning stimuli, viz. that they produce an amount of change far greater than their physical force will explain; and also that the amount and duration of the change has no necessary connection with the quantity or permanent presence of the stimulus. For instance, I take a needle, and using each time precisely the same amount of force, I scratch gently the following substances, a piece of glass, a piece of lead, a piece of wax, a cake of fulminate of mercury, a crystal of yellow biniodide of mercury, a healthy man's arm, and a diseased person's arm. The physical force employed in each case is precisely the same, the substance employed is in every instance identical, but the result differs as widely as possible. On the glass no visible effect is produced; on the lead a

small portion of the surface is scraped off; and on the wax a depression is made, and the displaced material is accumulated like a ridge on either side. In these three cases that needle has acted purely mechanically; and the amount of work done is exactly commensurate with the form and hardness of the needle, and the amount of force exerted in pressing the needle against the substance operated upon. In all the other cases, however, the scratching acted not as a mechanical force, but as a stimulus; and the result was not commensurate with the force applied; but was in each instance dependent upon certain peculiar properties of the substance acted upon. For example, in the cake of fulminate of mercury the stored-up force connected with the possible re-arrangement of its elements is so great that the mass is eminently unstable; and the little scratch disturbed the equilibrium so completely that an entirely new arrangement of its elements instantaneously took place, the molecules rushing with destructive violence into their new position. In the yellow crystal of biniodide of mercury a change of molecular arrangement commenced at the point acted upon, and spread from thence through the whole mass. Now it is evident that the result in these cases cannot be measured by the force employed. No addition to the force would have apparently altered the violence of the explosion of the fulminate; neither was a continuance of the scratching necessary to complete the change in the biniodide. The scratch was the

stimulus, but the result was entirely dependent upon the properties of the substance scratched. Precisely in the same way, and for the same reason, the scratch on the two arms produced entirely different results. In the healthy arm a line of roughened epidermis, and a slight capillary injection of the skin, were the only visible results, and in a short time these disappeared; whereas, in the diseased arm a series of changes were initiated which, passing through the stages of irritation, inflammation, suppurative and pyæmic fever, terminated only in the death of the patient. In this instance, also, nothing was added to the body, nothing remained in action; but the properties of the parts acted upon being entirely different, the result was equally diverse. Here, also, the dose had little or nothing to do with the result: a single scratch in a sufficiently diseased person being just as capable of producing fatal disease as a dozen.

The next point to be attended to is, that while the changes which take place in germinal matter are directly dependent upon its internal molecular arrangement, nevertheless the agent effecting these changes is invariably a mode of motion, or, in other words, physical force; and there is absolutely no proof whatever of the existence of such a thing as *vital force*, neither is there the slightest need for the conception of such a force. Living matter differs from dead material in its *properties;* and these alone are sufficient to explain all the phenomena; hence we must be careful to speak and think of *vital pro-*

perties, and to abjure altogether the false and misleading term of *vital force*.

An illustration taken from physics will be of much assistance in understanding the complex actions and re-actions of the living organism, will teach us much respecting the nature of disease, and will also point the way to its correct scientific treatment. Let us picture to ourselves a large establishment wherein are made various manufactures in iron, steel, brass, wood, &c., all of which are received in their crude states. We should thus have in one building a number of different machines, each constructed so as to do its own appointed work, and each requiring to be supplied with the material upon which it is to exert its formative power. In the case before us the machines themselves are constructed of the same materials as the substances which they elaborate; and it is easy to conceive that numerous machines, serving very different purposes, might be composed of the same relative proportions of iron, steel, brass, and wood; and, moreover, it is equally conceivable that the manufactured products might also contain the same relative proportions. In such a case chemistry would tell us that the manufactory can only turn out in a completed state the same quantity of iron, steel, brass, and wood, which it receives as material to work up. It could also analyse the machines; and finding them to consist of the same ingredients in the same proportions, it could explain the chemistry of the entire process; but it would have told us absolutely nothing of the manufacture

itself; and, moreover, the machinery might get out of order to an extent rendering it quite incapable of making any useful article, and yet the chemist might find nothing wrong. Let the physicist next examine our manufactures, and, tracing every process from beginning to end, he will find no process which he cannot explain; every result is the direct consequence of the force employed, and the effect in every instance precisely corresponds in amount to the quantity of force expended; but here, also, so long as he contents himself with measuring the temperature and calculating its mechanical equivalent; so long as he busies himself with elasticity, weight, expansion, contraction, &c., he will throw no useful light upon the intricate working of any one of the machines, nor will he show how any errors are to be corrected. Before this can be done each piece of apparatus must be studied anatomically, as in this way alone can its mode of motion be ascertained. The amount of mechanical force exerted in moving its several parts teaches but little; we must know all the possible motions of each individual part, and their influence; and we must be accurately acquainted with their order of sequence ere we can judge of the effect of the whole. This, even, is not enough, as most manufactures require their several parts to be prepared before they are fitted together, so as to ensure perfect articles; and since these preliminary operations, though essential for the perfection of the manufacture, are by no means necessary for its mere putting together; they may be slurred, over or

omitted, without the defect becoming at once apparent. Lastly, in such a manufactory there must be a large staff of workmen, each attending to his own work, and each obeying orders received from those placed over him. We have now an analogy to the living body sufficiently accurate to clear up many points of difficulty. The workmen of course represent the nervous system, the machines are the germinal matter, the products are the formed material; and the material brought into the manufactory is the pabulum. Glancing at our simile we at once perceive what will constitute perfect health, viz.:

1. Every man fully attending to his own business, and giving and obeying orders. (Healthy nerves.)

2. Every machine in perfect order, and made of the best materials. (Healthy organs.)

3. A sufficient supply of the crude articles on which it works. (Healthy food).

4. The thorough preparation of this crude material before using it, to make the more important manufactured articles. (Healthy assimilation.)

We can likewise, with equal facility, perceive what will constitute disease:

1. Any man neglecting his duty. (Disordered nervous system.)

2. Any derangement in any one of the machines. (Disease of tissues.)

3. An insufficient supply of crude material. (Defective food.)

4. Imperfect preparation of crude material. (Malassimilation.)

It is, of course, understood that this simile must not be pushed too far, since it is in many respects very imperfect, more especially as regards the interdependence of the various parts. For example, the nervous system performs its work by means of the force set free during the degeneration of its ganglionic cells; and hence is as much a machine as any other part of the organism, and, consequently, equally dependent with the rest on a proper supply of assimilated pabulum. Moreover, the source of motion in our manufactory is totally different from that in the living body; and could only be analogously represented by supposing each machine to be moved by the force extricated during the chemical decomposition of certain parts of the machinery; added to which, the living body has two peculiarities which are inconceivable by any mechanical arrangement, viz. first, that it cannot cease from work without tumbling to pieces; and, secondly, that it never makes its products directly from the material received, but forms them from its own substance, and repairs the damage thus induced with the materials supplied to it.

Notwithstanding these imperfections, however, it will serve my purpose in rendering intelligible many important points. Let us follow some of the crude material—say iron—from its reception into our establishment to its exit as formed material. The iron is received as a mass of cast iron direct from the furnace where it was smelted, and in this state is only fitted for the casting. If needed to make any

piece of machinery where toughness is required it must be forged and rendered malleable; if wanted for other purposes it must be converted into steel; or again it must be hardened; in other words according to the purpose for which it is ultimately required, it has to undergo various processes by which its molecular structure is modified; and unless these modifications are properly effected the resulting manufacture will be imperfect If, for instance, a piece of brittle cast iron is put where tough wrought iron should have been used, the article will break when exposed to a strain which, if properly made, it would have been fitted to endure; or if tough, soft iron is used where an elastic, springy steel should have been placed, the article will be found wanting in one of the most essential characteristics. Precisely analogous changes go on in the living body; the crude pabulum received from the *primæ viæ* must undergo many changes and modifications of molecular structure ere it is fitted to supply the wants of the higher tissues; and if any mass of germinal matter is obliged to assimilate pabulum lower in the metabolic scale than is best for it, the result will be a change in its own molecular constitution; and, as a consequence, an alterations in its functions, in other words, disease. Whether or not such a disease will be evident to others will depend upon the extent and gravity of the change. A slight deviation will give rise to no detectable symptom; and in such a case will exist as a predisposing cause. Such a state is called dormant disease, which represents an

amount of change in the molecular condition of a part that is not incompatible with the continued performance of the concrete function of the organ, but which will, nevertheless, endow the part with a property not possessed by the healthy germinal matter, viz. inability to resist some stimulus which, if applied to the healthy part, would have had no injurious effect. Like one piece of machinery with the cast iron where wrought iron should have been, it will do its work as if all were right, until a strain comes in a certain direction, when the cast iron will snap, and the integrity of the machine be destroyed. In this case the improper molecular construction of the iron is the predisposing cause, and remains dormant in the absence of the strain. The strain itself is the stimulus (exciting cause) of the disaster which results from its application. Whether such a deterioration will be transient or permanent must depend upon two causes; first, and chiefly, according to the continuance or otherwise of the mal-assimilation, because so long as such a part is supplied with ill-formed pabulum it cannot regain its health; secondly, according to the strength of the tendency in the part to reproduce its like, or to revert to its former condition. When the latter is strong, if really good pabulum is supplied, the new and diseased property will soon be lost; if the former, a result, most probably, of the duration of the deterioration, then, even with the most healthy food, a considerable time may elapse ere the part reverts to its norm.

These general principles may be applied to the explanation of every form of disease; the one condition which underlies them all being a change of motion in the germinal matter in response to some unusual stimulus.

Diseases thus considered are just as natural results of the altered circumstances, as health is the natural result of the original circumstances in which the system was placed; or, in other words, pathology is the physiology of parts in unusual circumstances.

The same considerations prove that there cannot exist any true resistance to disease, or any real *vis medicatrix naturæ;* all the changes which follow the application of stimuli being the direct and necessary results of the pre-existing molecular constitution of the part. Germinal matter must be said to act blindly; and to be just as ready to perfect a self-destructive act as to bring about a change which may tend to throw off the disease. In fact, it cannot be imagined as exercising any choice in the matter. It is as much a machine as any dead piece of mechanism.

The well-known tendency of a large number of diseases towards recovery is traceable to the *inherited properties of the germinal matter*; and just as in certain families we meet with inherited tendencies to certain diseases, and at once trace them to peculiarities of molecular constitution of the parts concerned, so in the majority of cases the tendency of germinal matter to resort to its original mode of motion, after it has been turned out of its normal

course, is sufficiently strong that most acute disturbances speedily and spontaneously come to an end.

Diseases are grouped together according to resemblances in their origin, their locality, or their course; but for the purpose of determining what kind of treatment will be best adapted for their cure, we must ascertain what the stimulus is which has roused into activity the abnormal properties of the germinal matter implicated in the morbid process.

I think we are now prepared to answer the question as to how diseases ought to be treated, and also to test the propriety of many of the means of cure most frequently resorted to.

As during all the manifestations of life the three essential constituents are germinal matter, pabulum, and stimulus, we must attend to all these in our endeavours to remove disease. The study of the changes of germinal matter constitutes pathology; the study of pabulum, dietetics; and the study of the action of stimuli includes the whole field of the drug-treatment. I will, however, begin with the last point, as that most germane to my subject.

Every true drug acts as a *stimulus*, and the symptoms it produces are the evidence of this action. Now, according to our explanation of the action of stimuli, it must follow that drugs will act very differently, according to the pre-existing condition of the matter to which they are applied. For example:—

1. Before a drug can act chemically, it must have reduced the substance upon which it acts to the

chemical degree of molecular constitution, or, in other words, drugs cannot act *chemically* on living matter; they must kill it first, and having thus split it up into chemical compounds, they will combine with these according to their wont. This is a very important fact, as showing that unless we desire to destroy a part by chemical agents, as with caustics, we must not attempt to prescribe them as acids or alkalies, or, indeed, in virtue of any of their chemical properties, unless we can limit their sphere of action to dead matter. We may justifiably employ chemicals to modify the condition of unabsorbed food, or to secretions after their formation; but to expect a chemical action within the metabolic sphere, is to look for an impossibility, and to reap a failure. The sphere, therefore, of chemical treatment is outside the living matter. It is doubtless true that many invaluable drugs are also powerful chemical agents; nevertheless, it is capable of demonstration that they influence germinal matter, not in virtue of their chemical affinity, but in virtue of their power to stimulate into activity some preexisting property of the germinal matter itself. It is on this account that chemical substitutes can never be used in true scientific drug-treatment. If, for example, an antacid were required, the practitioner might use any of the alkalies or alkaline earths, and if to neutralise the acids of dyspeptic fermentation were the only purpose for which it was required, the substitution of one base for another would be unimportant; but since every alkali and

alkaline earth has its own peculiar power to stimulate germinal matter, the use of each one is apt to be followed by its own specific effects, over and above the chemical action upon the acids of the decomposing food. In the stomach they all act as alkalies, and neutralise the acid with which they come into contact; but beyond the stomach, in *addita* of the body, potash acts as potash, soda as soda; and nothing short of an accurate foreknowledge of these specific effects, and a judicious avoidance of overdoses or protracted usage, can prevent a physician from doing infinite damage by an attempt to rectify a chemical fault by a chemical corrective.

2. A drug cannot act as a specific stimulus unless the germinal matter possesses the property of responding to its peculiar mode of impression; and as the germinal matter of different organs differs essentially in its properties, it follows that every different substance will modify the changes of germinal matter in different parts or in different ways. We may expect, therefore, to find that every substance capable of modifying metabolic changes will have what looks like an elective affinity for certain organs; or in other words, a drug, though brought into contact with germinal matter in all parts of the body, will initiate new modes of motion in certain parts only.

3. A drug which is capable of acting on a given part of the body in a certain way, as long as the molecular movements of that part are normal, may act in a totally different way upon the same part, if

a new set of movements are going on. In other words, the action of a drug upon a healthy and a diseased organ may differ to any extent.

4. In like manner, a drug may be perfectly incapable of acting on a certain organ while it remains healthy, and yet be capable of modifying to a great extent any morbid changes which it may be undergoing.

All these variations are the natural conclusions deducible from the principles we have laid down, and experience has abundantly proved every one of them.

Such being a general outline of drug-action, it follows as a necessary consequence that no drug can be used judiciously as a means of cure, until we have become acquainted with its powers of influencing the healthy functions. Unless we know accurately what parts of the living germinal matter it will influence, and also what changes it will inaugurate, we cannot prescribe it with precision. A proving of a drug on the healthy body, however, will be insufficient, since we have seen that it may and probably will act very differently on the same part when diseased; and hence we must ascertain this point also. It is at this point that Hahnemann meets us with his invaluable discovery, viz. that a drug invariably produces in the diseased organism a series of changes precisely opposite to those which it produces in health, and that consequently it removes from a diseased part the entire series of symptoms which it would excite in the same part when

healthy; and hence his law for the selection of a drug is "*Similia similibus curantur.*" I shall return to this, but in the meanwhile must proceed with the inquiry as to how the treatment of disease should be regulated by the light of the most advanced physiology.

Bearing in mind that germinal matter alone is truly living, and that every substance found in the body is produced by the same protoplasm, we must not expect to supply defects in formed material by supplying it direct—everything that enters the stomach is changed into the metabolic state before it can become part of any formed material, whether structural or not. Every oil-globule found in the cells of fat or elsewhere has been produced by germinal matter, and in no instance consists of oil which has been simply absorbed and re-deposited. So also with albumen, fibrin, gelatin, *et hoc genus omne;* not one of these can be made to enter directly into any of the structures of similar composition; each must first lose its identity, and, emancipated from all its dead chemical property, must enter the metabolic state, and thence be reproduced by deposition as formed material. The practical lesson to be learned from this is, that chemical analysis of food, as far as proximate principles are concerned, will be of no assistance whatever in regulating the diet. The relative amount of albumen, fibrin, gelatin, oil, &c., tells us nothing, as all these cease to exist before true nutrition becomes possible. Ultimate analysis is useful, as we know that the

body must receive from without all the carbon, oxygen, hydrogen, nitrogen, calcium, ferrum, phosphorus, which are found in its formed materials; but, beyond the important fact that the compounds of these must be in the colloid condition, the superiority of one form over another as food is regulated by other proportions than those deducible from chemical analysis. Their physical forms, as influencing the facility of their disintegration; the effect they produce on the gastro-intestinal mucous membrane; the more or less readiness with which they are absorbed, &c., are all of vastly greater importance than anything we can discover by chemical re-agents. Hence a chemical diet-table, treating of proximate principles, is among the most misleading of all the so-called helps to the treatment of disease or the maintenance of health.

If all diseases consist in changes in modes of motion of germinal matter, the converse must likewise hold true, and all changes in the modes of motion of germinal matter must be looked upon as disease. *Hence true cure must in every case consist wholly and solely in a restoration of the original mode of motion to those portions of germinal matter which are diseased;* and any benefit which may be derived in a cure of disease by producing changes in any other part of the body, must be considered as *indirect*, and the process regarded as *spoliative.** One would imagine that

* I do not by any means wish it to be understood that spoliative treatment should never be adopted. I know well that in many chronic diseases the system is loaded with material of a low degree of vitality, of which it should be relieved as an important step

such a statement as this would be hardly necessary, as it must be self-evident to all who think calmly over the subject; and yet it is all but ignored in practice, and the only system which holds it up as a standard of comparison and adheres to it by the sick-bed is denounced as unscientific and absurd. To restore changed action, by directly influencing the diseased part, is the very essence of specific treatment, and Dr. Drysdale has admirably defined a true specific to be "a remedy which cures by the absorption of its whole physiological into its therapeutic action;" or, paraphrasing this to suit the point from which we are at present viewing the question, a specific is a remedy whose therapeutic effect is to restore the normal mode of motion to the disordered germinal matter, and whose physiological effect would have been to have produced precisely the same disordered action, had it not already existed. The one effect exactly balances the other, and the practical result is that there will be no evidence of medicinal action at all; the cessation of disease and the restoration of health are the only consequences of the administration of the drug. This is the *beau ideal* of treatment. There is no spoliation—no waste of force; the existing error is corrected, and all goes on as if disease had never been.

I now pass on to enquire how far the dominant school of medicine follows this course. At the very

towards cure. But even here a diet so arranged as to compel the system to work up and work off its bad material is infinitely to be preferred to any attempt to effect the same result by disturbing doses of drugs.

foundation of almost all their treatment lies the error, that they give remedies *to do something* in place of to *undo*—they use medicines to produce their direct action, or in other words, to *produce a morbid change.* Now this must be wasteful and spoliative, and can only be defended on the ground of expediency; it is literally at best doing evil that good may come, and unless it can be distinctly proved that there is no other known way, it cannot be recommended. No wonder that many thoughtful practitioners have come to the conclusion that it is better to leave diseases alone, and to trust to the well-ascertained "tendency to revert to the original type" to correct the errant action of the disordered part; and so it would be, if spoliative treatment were the only possible alternative. There is, however, no necessity for this; for it has been fully proved that drugs properly chosen will correct existing derangements, and that they will do so without producing new ones; and this is their proper function.

Take an example. *Colocynth* has been proved to act on the bowels, and to produce colic and diarrhœa. The dominant school use it, accordingly, where they wish to empty the bowels, and give it in a dose capable of producing its physiological or pathogenetic effect; but not wishing to induce colic as well as purgation, they add *hyoscyamus*, which experience has taught them counteracts that part of its effects; and having got rid of the colic, they are well satisfied with the result.

The homœopath, on the contrary, gives *colocynth*

where colic and diarrhœa already exist, and, without the aid of *henbane* or any other adjuvant, the colic and diarrhœa both cease, and the patient is restored to health. The allopath, however, has given the remedy because he wanted to produce an overaction of the bowels, and accordingly *colocynth* used after the manner of the homœopath would not suit his purpose; unless, indeed, it was a case of constipation associated with colic, in which instance *colocynth* will frequently cure the one, and in so doing overcome the other, which is often a mere consequence, and does not own a separate origin. If, however, no colic exists, he must ascertain the exact condition of the intestines upon which the constipation depends, and acting upon this knowledge, select the proper specific to correct the error. To give an aperient under any circumstances, is contrary to the principles we are now defending, because it is producing a diseased condition. To restore the natural action of the bowels is quite legitimate, but to produce an overaction must be spoliative, and hence to be avoided whenever it is possible. To revert to our mechanical illustration, what workman in his senses would try to correct the wrong action of one machine by making another machine act wrongly, even though the second disturbance should in some measure counterbalance the first? Unless it were the only means of preventing the destruction of more or less of the machinery, such a step would be unwarrantable, and certainly could not be defended so long as a direct correction of the original disturbance were

possible. What has been said against aperients may with equal justice be said against all other developments of the physiological action of drugs; and thus we arrive at an important point regarding the dose of a drug, which, according to these views, should always be too small to produce its physiological effect.

A careful survey of the therapeutics of the most advanced practitioners will demonstrate the fact that drug administration has become more and more limited chiefly to three classes, viz. sedatives, tonics, and specifics. Of specifics such as Iodide of Potassium, Quinine, &c., I shall say nothing, since in most of these the relationship between drug and disease is of the kind I am advocating; and any question we may still be disposed to raise has reference rather to the mode of administration than to the art of selection.

Of the three classes, however, that of sedatives is the one most frequently abused. Nothing seems to me more astonishing than the manner in which the most advanced physiologists recommend the use of sedatives; and the insane rush after every new pain-killer by practitioners of all classes shows clearly how little a correct physiology has hitherto regulated the practice of the profession. Upon what principle this unscientific use of narcotics is defended I am at a loss to conceive, unless it be that, recognising their inability to exert any direct effect on the progress of the disease, they think they will, at any rate, render that progress as comfortable as possible to the patient.

Just as if the well-wishers of France should have cut the telegraph-wires to prevent the Assembly at Versailles knowing anything of the doings of the Communists in Paris, and have defended the act as a wise precaution lest the deliberations of that august body should be disturbed by the exciting nature of the news brought to them. I am well aware that much has been said of the advantages of physiological rest, and of the exhausting effects of pain; but let it be remembered that I am not arguing against the removal of pain, but against the prevalent method of achieving the result; neither does it appear to me possible to conceive anything less *physiological* than the rest obtained by inducing a morbid state of the nervous centres. Who, in his senses, believes in a really innocent narcotic? What were we so confidently told about Bromide of Potassium and Chloral Hydrate? Were they not both lauded as "blessings to humanity," and perfectly harmless removers of pain and sleeplessness? and are not the medical journals already teeming with warnings of their dangers, or at least their many "inconveniences?" I was much pleased, and not in the least surprised, to read the following report of Dr. Maudsley's opinions in the *Lancet* of August 12th, 1871. It is as follows:

"Dr. Maudsley began by seriously doubting if it were always a wise thing to stifle excitement; and whether a chemical restraint put upon the brain-cells was not often as injurious to the patient as a mechanical restraint imposed upon his limbs. He

thought that sedatives were given far too recklessly; that, although they might relieve symptoms, they often only served to push the patient further down the hill, and, as often as not, retarded recovery. He thought that the whole range of sedatives, including Bromide of Potassium and Hydrate of Chloral, were equally capable of being abused; that by giving them we often seriously damaged the patient's general health; and, instead of curing, we often merely 'made a solitude and called it peace.'"

These are words of sound wisdom which I trust will bear practical fruit. Dr. Maudsley is too sound a physiologist and too clear a thinker to be long misled by so deceptive and unscientific a procedure as that he comments on. Surely the time must soon arrive when physicians will learn that they have a higher mission than that of putting disease out of sight; that it is a wiser and better plan to look to the future; to let the patient suffer pain on the way towards health rather than enjoy present relief at the cost of drifting into hopeless disease.

It is very lamentable to find an accomplished physician like Dr. Anstie claiming, as among the glories of our recent advances in Therapeutics, the subcutaneous injection of Morphia, and the employment of Bromide of Potassium and Hydrate of Chloral.

So long as the fundamental error of producing a new disease for the purpose of curing one already existing—no matter whether the new morbid action is set up in the part already diseased, or in some

more distant organ—so long as practitioners will give drugs in disturbing doses, so long no real progress in drug-treatment is possible. Either the entire facts of our advanced physiology must be interpreted differently, or the very foundations of old-school drug-treatment must be relaid.

Physiological experiments with drugs will continue absolutely barren of therapeutic advantages while their results are utilised in so erroneous a manner. If a remedy is found experimentally to paralyse the motor ganglia of the spinal cord, of what possible use can this knowledge be if the remedy is to be given in paralysing doses? What true physiologist would recommend the production of such a serious morbid condition as a method of cure? When, however, drugs are employed rationally, that is, specifically, such a knowledge becomes invaluable, since upon the ascertained principle that drugs produce the exactly opposite effect in disease to that which they do in health, we know that such a drug, in a proper dose, will remove paralysis of the cord, provided the restoration of its normal mode of motion has not been rendered impossible by an entire change in its constitution, or, in other words, provided disorganisation of the cord has not already taken place.

If space permitted I might show that the fashionable methods of treating disease by stimulants and high feeding have both been carried to an extreme which is opposed to all the teachings of physiology; but here, the error being simply one of degree, it will probably right itself; and I have therefore pre-

ferred confining my attention to drug-treatment where the errors are fundamental, and where the change must be thorough to be of any real value.

Let physicians once realise to themselves the true nature of life, of health, and of disease, and they will never commit the grave error of producing one disease for the cure of another, except, indeed, under protest, and as a matter of expediency.

Let them once recognise the true nature of drug-action, and its specific relation to diseased action; and they will receive a light wherewith to guide them through the difficulties and intricacies of a consistent therapeia.

Let them be content to follow and help the natural course of diseases rather than force a method of their own imaginings upon a blindly-acting machine which can offer no resistance, and may therefore be led to destroy itself; and they will cease to prescribe drugs to produce disturbances, under the idea that they can in this way drive the pre-existing disease to a happy termination.

And, finally, I must express my satisfaction that every real step in the progress of modern physiology has tended to strengthen the scientific foundation of specific drug treatment; and that homœopathic physicians are able to stand abreast with all the workers in this vast field of research, and, accepting with deep thankfulness each new discovery, are in a position to render it useful at the bed-side of their patients.

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